529 Rec'd PCT/PTO 12 MAY 2000

FORM PTO-1390 (REV 10-98) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C.371

ATTORNEY'S DOCKET NUMBER	
HHI-023US	
U.S. APPLICATION NO. (If known, see 37 CFR 1.5)	
09/554343	
INTERNATIONAL APPLICATION	INTERNATIONAL FILING DATE
PCT/DE99/02906	**14 September 1999 (14.10.99)**
PRIORITY DATE CLAIMED	
14 September 1998 (14.10.98)	

TITLE OF INVENTION
MOTOR-DRIVEN SCREW DRIVER

APPLICANT(S) FOR DO/EO/US
Konstanze SAATHOFF and Achim LÜBBERING

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C.371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371 (f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371 (b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) **(unexecuted) (4 sheets);**
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98. **(2 sheets) with Form PTO-1449 (1 sheet);**
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included
13. ☒ A FIRST preliminary amendment **(5 sheets);**
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: **Transmittal Letter (2 sheets in duplicate); PCT International Published Application in German (WO 00/15393) (with International Search Report attached) (23 sheets) with Translation attached (13 sheets); Certificate of Express Mailing (1 sheet); and Return Postcard.**

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NO.
09/554343	PCT/DE99/02906	HHI-023US

17. ☒ The following fees are submitted:

	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) .(a/o January 1, 2000):		
Search Report has been prepared by the EPO or JPO.....**$840**		
International preliminary examination fee paid to USPTO (37 CFR 1.482).....**$670**		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....**$690**		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....**$670**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....**$96**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$840**	
Surcharge of **$130.00** for furnishing the oath or declaration later than 20 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$--	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	**18** -20 =	**0**	X **$18.00**	**$0**	
Independent claims	**1** -3 =	**0**	X **$78.00**	**$0**	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **260.00**	$--	
TOTAL OF ABOVE CALCULATIONS =				**$840**	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28)				$--	
SUBTOTAL =				**$840**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$--	
TOTAL NATIONAL FEE =				**$840**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$--	
TOTAL FEES ENCLOSED =				**$840**	
				Amount to be: refunded	$
				charged	$

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. **12-0080** in the amount of **$840** to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **12-0080**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Anthony A. Laurentano, Esq.
LAHIVE & COCKFIELD, LLP
28 State Street
Boston, Massachusetts 02109
United States of America
(617)227-7400
Date: 12 May 2000

Anthony Laurentano
SIGNATURE

Anthony A. Laurentano
NAME

38,220
REGISTRATION NUMBER

Applicant or Patentee: **Konstanze SAATHOFF and Achim LÜBBERING**
Serial or Patent No.: **09/554,343**
Filed or Issued: **May 12, 2000**
Title: **MOTOR-DRIVEN SCREW DRIVER**

Attorney's Docket No.: **HHI-023US**

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN **JOHANNES LÜBBERING AG**
ADDRESS OF SMALL BUSINESS CONCERN **Haldenstrasse 1**
CH-6340 Baar, SWITZERLAND

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

☐ the specification filed herewith with title as listed above.

☒ the application identified above.

☐ the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights in the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

*NOTE Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27)

NAME_____
ADDRESS_____
☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

NAME_____
ADDRESS_____
☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statement were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING VOLLAND Reto C.
TITLE OF PERSON OTHER THAN OWNER Chairman
ADDRESS OF PERSON SIGNING Rütistrasse 12 ; CH-8132 Egg Switzerland
SIGNATURE _____ DATE 10/7/2000

(Atty Docket No.: HHI-023US)

IN THE UNITED STATES PATENT DESIGNATED OFFICE (DO/US)
(National Phase of International App.: PCT/DE99/02906, Publication No. WO 00/15393)

In re the
application of: **Konstanze SAATHOFF *et al.***

International Application No.: **PCT/DE99/02906**
(Publication No. WO 99/00/15393)

International Filing Date: **14 September 1999**

U.S. Serial No.: **Not Yet Assigned**

Filed: **Herewith**

For: **MOTOR-DRIVEN SCREW DRIVER**

Attorney Docket No.: **HHI-023US**

BOX PCT
Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Preliminary to examination of the above-referenced patent application, please amend the enclosed above-titled International patent application as follows.

In the Specification:

Page 1, line 2, insert the following title "**Background of the Invention**".

Page 3, lines 23-24, please delete the sentence "Said object on which the invention is based is achieved by a manual wrench with the features of Claim 1."

Page 3, line 25, insert the following title: "**Summary of the Invention**".

Page 8, line 22, insert the following title: "**Brief Description of the Drawings**".

Page 8, line 26, insert the following title: "**Description of Illustrated Embodiment**".

In the Claims:

Please amend the claims as follows.

1. (Amended) Motor-driven manual wrench [containing] having a drive motor [to which a first torque limiter is attached] and [containing] a head [(1)] that has the driving tool or a receptacle for a driving tool, said wrench comprising

a ratchet drive [(6)] located in the head and a torque limiter [(5)] attached to the ratchet drive [(6) being located in head (1)] and to the drive motor such that the manual wrench forms a manually operable torque wrench whose transmittable torque is determined by the torque limiter [(5)].

2. (Amended) Manual wrench according to claim 1, [characterized in that] wherein the head [(1)] is mounted replaceably on [the rest of] the wrench.

3. (Amended) Manual wrench according to claim 1 [or claim 2], [characterized by] further comprising an adapter (12) which is connected to the drive shaft [of head (1),] and to [the] an output shaft of the motor.

4. (Amended) Manual wrench according to [one of the foregoing claims] claim 1, [characterized in that] wherein the head [(1)] is designed as an angle head [whose] having an output shaft [is] offset relative to the drive shaft.

5. (Amended) Manual wrench according to [one of the foregoing claims] claim 1, [characterized in that] wherein the torque limiter [(5)] is designed to be adjustable such that the transmittable tightening torque is adjustable to specified values.

6. (Amended) Manual wrench according to [one of the foregoing claims] claim 1, [characterized in that] wherein the torque limiter [(5)] has an articulated joint [(8),] with an articulated body [(9)] held between two supports, [the] one support [(15)] being pivotably mounted at a distance from the articulated body [(9)], said one support enabling an articulating motion between [this] the support [(15)] and the articulated body [(9)], [and the] said one support having a pivot axis [of this support (15)] coinciding with [the] an axis of a shaft [(4)] whose transmittable torque is limited by the torque limiter [(5)].

7. (Amended) Manual wrench according to [one of the foregoing claims] claim 1, [characterized by] further comprising a visual display which is activatable when a specified tightening torque is obtained.

8. (Amended) Manual wrench according to claim 7, [characterized in that] wherein the display is mechanically activatable.

9. (Amended) Manual wrench according to [one of the foregoing claims] claim 1, [characterized by] further comprising an electrical sensor which generates a signal when [the] a specified tightening torque is obtained.

10. (Amended) Manual wrench according to claim 9, [characterized by] further comprising an electronic circuit which is effectively connected with the sensor, the circuit activating an one of an acoustic display and[/or] a visual display when the predetermined number of driving operations implemented with a specified tightening torque is obtained.

11. (Amended) Manual wrench according to claim 9 [or Claim 10], [characterized by an] wherein the electronic circuit [which is effectively connected with a sensor, the circuit activating an acoustic and/or visual] activates one of the displays when a signal is received from the sensor.

12. (Amended) Manual wrench according to [claims 8 through 11] claim 8, [characterized in that] wherein the display is located at the head [(1)].

13. (Amended) Manual wrench according to [one of the foregoing claims] claim 1, [characterized in that] wherein the manual wrench is configured [has an elongate design as a] as an elongate rod-type wrench.

14. (Amended) Manual wrench according to [one of the foregoing claims] claim 1, [characterized in that] wherein the head comprises a flat output element[means is located at head (1)].

15. (Amended) Manual wrench according to [one of the foregoing claims] claim 1, [characterized in that the manual wrench is equipped with] further comprising a wireless power supply for the motor.

16. (Amended) Manual wrench according to [one of the foregoing claims characterized by] claim 1, further comprising a tubular housing accommodating the motor and a drive train, [which] said housing is designed with high bending strength, which bending strength during manipulation of the wrench allows for the transmission of considerably higher tightening torques to the driving operation than from the motor drive, with the rod-shaped housing having a grip area for manual actuation of the manual wrench.

17. (Amended) Manual wrench according to claim 16, [characterized in that] wherein the housing [consists of] is formed of metal.

18. (Amended) Manual wrench according to claim 17, [characterized in that the housing consists if] wherein the metal is light metal.

REMARKS

Applicant amends the specification to address minor formal matters. Applicant also amends the claims to remove multiple dependencies and to provide proper antecedent basis. The foregoing amendments introduce no new matter.

Entry of the foregoing Preliminary Amendment is respectfully in order and requested.

If there are any questions regarding the amendments to the application, we invite the Examiner to call Applicants' representative at the telephone number below.

Respectfully submitted,

LAHIVE & COCKFIELD, LLP

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Date: **May 12, 2000**

Motor-Driven Manual Wrench

The invention relates to a motor-driven manual wrench.

Said wrenches are used, for example, in the automotive field, especially in manufacturing plants but also in repair shops. In practice, manual devices are designated manual wrenches even though said devices are motor-driven. Said devices are designated hereafter as rod-type wrenches when they have a rod-shaped housing; they are designated pistol-type wrenches when their housing is of an offset design.

The drive means is usually electricity or compressed air. With electric devices, the motors are usually supplied with electric power from a central source via a connecting cord, or in a decentralized manner from a storage battery; however, wrenches with other types of power supply, e.g. battery, capacitor, or other electrical storage means are conceivable.

Based on a possibly existing pneumatic or electrical power connection, said wrench then has an actuating grip, then a motor and gear means connected to it, usually a planetary gear means, and connected to said gear means a clutch to which the freely terminating end section of the wrench designated the "head" is attached, said head conceivably being designed as straight or – especially with rod-type wrenches – as an angle head. In practice, said rod-type wrenches with angle heads are frequently no longer designated rod-type wrenches but "offset wrenches." A head is designated an angle head when its drive shaft is offset relative to the output shaft, frequently at an angle of 90°. At the free end of the head, the output shaft is usually designed square so that attaching sockets with the desired wrench size for driving may be attached.

In practice, it has proven advantageous to design said heads as separate components since they are the first component group of the wrench to wear out, especially when they are designed as angle heads, making fast and inexpensive repairs to the wrench feasible simply by replacing the head. Additionally, said replaceable heads offer the advantage of arranging various head designs attaching to the actual base unit of the wrench so as to ensure optimum accessibility of the screwing location.

Safety-relevant screwing locations, e.g. in the area of the steering or brake systems, are usually implemented in a two-step tightening process: First a driving

operation of approximately 80% to 90% of the target tightening torque is performed as quickly as possible, followed by a relatively slow further tightening of the bolt. The load release between these two steps during tightening takes into account the settling behavior of the screwing location and ensures especially reliable adherence to the desired target or nominal torque from the tightening torque actually achieved during the driving operation.

The initial fast tightening during said two-step driving operation is usually performed by motor by means of said manual wrench. The end of this motorized initial tightening of the bolt is reached by a torque limiter which is either directly incorporated into the manual wrench, or, in the case of pneumatic so-called "choke-type" wrenches, the maximum torque to be applied can be limited by the air pressure with which the tool is driven so that here the torque limiter attached to the drive motor is implemented outside the actual tool.

Subsequently, the worker must use a second device, i.e. a hand-actuated torque wrench, since the motorized manual wrench cannot ensure the required precision needed to maintain the tightening torque. The torque wrench has the required precision so that, within the range of specified tolerances, the torque wrench releases precisely at the preset nominal torque, for example, by means of an articulated mechanism, such that a clearly audible clicking and a certain amount of backlash of the torque wrench is generated which indicates that the correct tightening torque has been obtained. From practical use, torque wrenches are known which are adjustable or which release at the torque permanently preset at the factory. DE AS 21 06 263 also shows a torque wrench designed as an articulated wrench.

A motor-driven, hand-held wrench is known from US 4,060,137, which wrench has means for torque limitation and the possible automatic shutoff of the wrench when a preset torque is achieved. This principle of this wrench is based on the design of the pistol-type wrench, with the components known from a pistol-type wrench, however, forming almost exclusively the grip area of a considerably larger, roughly flatiron-shaped, large housing. Said wrench does not have a freely terminating "head" in the aforementioned sense; rather, connected to the drive unit are gear means which in turn lead to the grip and the connection for the compressed-air supply provided therein. There is no provision for operating the wrench without the motor drive. The release precision of the pneumatic torque limiter is possibly insufficient for many safety-related screwing locations.

From practical use, a manually operated torque wrench from the Tohnichi Company is also known to which a air motor is attached and which consequently is not designated by the manufacturer or the distributor of these tools as a motorized manual wrench but instead as a torque wrench ("torque wrench with air motor"). Said torque wrench first permits the motorized tightening of the screw connection, the otherwise unmodified torque wrench being subsequently employed in the usual known manner. The manipulation of this device is arduous since it has comparatively large dimensions due to the attached compressed-air motor and thus poor accessibility to restricted screwing locations. Manipulation is further impaired by the fact that the relatively high weight of the air motor lies outside the longitudinal axis of the torque wrench such that the user must constantly compensate for this eccentricity by a correspondingly tighter, tiring grip in order to avoid unwanted tilting motions of the tool around its longitudinal axis.

DE 25 20 250 A1 and DE 296 18 817 U1 each show a wrench with a torque limiter and ratchet drive, said devices being the only torque limiters provided on the wrench.

The object of the invention is to create a motor-driven manual wrench which allows for speedy work and the quick implementation of a driving operation, even with two-step tightening.

Said object on which the invention is based is achieved by a manual wrench with the features of Claim 1.

The invention proposes in other words to combine the motor drive normally provided in the manual wrench with an additional ratchet drive containing its own torque limiter as they are provided in torque wrenches. In general, the designation "ratchet drive" means any drive means which permits transmission of a driving torque in one direction of rotation and which moves freely in the opposite direction, e.g. a ring gear with locking mechanism which permits fixing or guiding in one direction, said ratchet drive often being designated a freewheel in the art.

The proposal according to the invention achieves the following object: After the manual wrench is placed on the bolt, the bolt can be gripped by the motor-driven manual wrench until the latter's torque limiter releases, and subsequently, with no requirement of

removing the manual wrench, the correct torque can now be monitored or obtained, i.e. by now having the grip of the wrench function as the grip for the torque wrench, and allowing the two work steps "gripping the bolt" and "checking the bolt" to be performed by one person in one step without changing tools; i.e. actuation of the torque wrench is not performed by the motor drive but by the purely manual actuation of the wrench until the torque limiter located in the head and connected to the ratchet drive releases.

The two torque limiters, first for the motorized and second for the manual use of the manual wrench, are typically set for different values so that screwing locations with two different obtainable torques, and correspondingly two-step tightened screwing locations, are possible without having to adjust or modify the manual wrench.

When mention is made below without further explanation of a "torque limiter," it is understood that the additional torque limiter in the head of the manual wrench is always referred to, while the first torque limiter attached to the motor drive of the manual wrench is viewed either as an integral, already present component of the manual wrench or as an external device such as the compressed air supplied to a pneumatic choke-type wrench.

A torque wrench constituting the manually actuated manual wrench may be designed in the known manner as an articulated wrench or as a bending bar, where mechanical monitoring is performed when the torque wrench is designed as an articulated wrench while electronic monitoring may be provided when the torque wrench is designed as a bending bar.

The target or nominal torque at which the torque limiter releases is usually higher than the shutoff torque of the motor-driven wrench. In this way, the two-step driving operation can be performed by first having the off switch already provided in the wrench, as is common on motor-driven wrenches, release at a specified torque which may correspond to about 80% to 90% of the target torque. In an electrically powered manual wrench, this can be performed by a sensor which shuts off the motor.

Subsequent to this first tightening or driving step, the wrench may be used as a non-motorized but manually operated wrench like a torque wrench until the torque limiter during this second tightening or driving step releases at 100% of the preset target tightening torque which is set not on the actual wrench but on the torque limiter. This

setting can be permanently specified and thus immune to manipulation; however, it may be advantageous to provide adjustability by the user so that the manual wrench may be easily adapted to differing driving conditions.

The proposed manual wrench considerably simplifies the work sequence since the user does not have to continually manipulate two different devices. By avoiding having to continually lay aside the motorized manual wrench with its relatively sensitive mechanism to pick up a torque wrench, an additional effect is that the comparatively expensive and sensitive tool is used more sparingly and its life therefore extended.

According to the invention, the torque limiter and ratchet drive are both located in the head of the wrench. In this way, a compact assembly is created in which the individual functional parts are optimally adjusted and matched to each other.

In particular, if the head is replaceably mounted on the rest of the wrench, the known advantages of a replaceable head are achieved. In particular, this approach allows the base units of existing wrenches to be retrofitted with heads designed according to the invention so that in a comparatively inexpensive way, manual wrenches may be equipped according to the invention with the additional function of a torque wrench.

An adapter may be advantageously provided which at one end connects to a standardized drive shaft of the head, and at the other end– depending on the base unit used – has a connector adapted to its output shaft. This approach allows for inexpensive manufacture of the heads designed according to the invention in large production runs, while enabling adaptation to a multiplicity of different wrench types in a similarly inexpensive way by using suitable adapters. In particular, provision can be made to design the drive shaft of the head without adapters as well for connection to a predetermined type of output shaft so that wrenches with said output shaft may be provided with the head designed according to the invention without using an adapter.

The torque limiter may be designed advantageously as an articulated element in known fashion so that by bending, reaching the target torque is displayed to the user and – except for the mentioned facilitation – the wrench may be manipulated in the manner familiar to the user without relearning the procedure.

On traditional articulated elements, the pivotably mounted support is pivotably mountable in the area of the tool shaft. The axis to be limited in terms of the transmittable torque is located at a distance from this position. In contrast to this approach, in the proposed manual wrench a lever arm between these two pivoting or rotating axes is advantageously obviated by mounting the articulated element such that the pivotable support present in such articulated elements, which support tensions the actual articulated body against a second support, is mounted to pivot around that axis, which axis simultaneously is also the axis for which the transmittable torque is to be limited. This approach ensures that the manner in which the user grasps the tool can have no effect on the shutoff torque of the torque limiter, thereby improving the precision of the shutoff torque since it is dependent only on the design conditions of the tool and not on the manipulation of the tool.

Provision may also be made advantageously for a visual display which is activated when the specified target tightening torque is obtained. It is especially simple, functionally reliable, and inexpensive to provide that the display be activated mechanically, for example, by changing color in a view window on the wrench, or by an axially movable pin, a pivotably movably mounted bar, or a similar approach.

As an alternative to or supplemental to said mechanical displays, an electrical sensor may be provided which generates a signal when the specified target tightening torque is obtained. Said signals may be sent by wire or wirelessly, e.g. via radio, for example, to a central control unit located remotely from the manual wrench, which control unit can record the number of driving operations and/or the level of the tightening torques, or at minimum, the achievement of the specified target torque.

Said signals from the electronic sensor may, however, also be evaluated at the manual wrench itself by an electronic circuit which, for example, triggers acoustic or optical signals by electrical means, for example, by a pilot light or by a high-frequency signal tone when, for example, the specified tightening torque is obtained.

As an alternative to or supplemental to said display, the electrical signals of the sensor may also be evaluated by the electrical circuit so as to activate said visual and/or acoustic display after a specified number of correctly implemented driving operations. In this manner, the worker may be provided in a supporting way with a functional check of his work. For example, when wheels are bolted on by means of five bolts, the display can

be activated after each implementation of the five correct bolting operations. Thus it is possible for the worker simply and reliably to monitor his work by the fact that after each wheel has been properly bolted, the acknowledgment signal or visual display appears.

The mechanical or electrical, visual, or acoustic display may be advantageously provided in the head of the manual wrench. As a result, not only is said display located optimally within the visual and audible range of the worker, but in this way the head designed according to the invention can have especially advantageously all advantageous functions and display options such that an especially simple retrofit of existing manual wrenches becomes possible, or an especially simple repair of manual wrenches is facilitated by the fact that the head having all functions may be replaced completely.

If the manual wrench is designed with an elongate housing as a rod-type wrench, manipulation of the manual wrench is simplified as compared with the aforementioned pistol-type wrenches since its design is similar to that of commercially available likewise rod-type torque wrenches and a correspondingly familiar manipulation is facilitated.

In particular, when said rod-type wrench is provided with an angle head, simple and efficient manipulation of the wrench, both initially as a motorized wrench and subsequently as a torque wrench, becomes possible requiring the least possible use of force by the user, said user being able to maintain his grip on the wrench, i.e. without having to shift the position of the manual wrench or manipulate it in some other manner.

The easy access to difficult-to-access screwing locations may be facilitated by the use of a flat output means located on the head of the wrench. This may be accomplished in a known manner by attachment to the output shaft of the wrench or of the angle head so that, depending on the situation, the flat output means may be used or removed from the manual wrench. Alternatively, it is possible to integrate said flat output means directly into the head to achieve especially compact dimensions for the tool. In this regard, a flat output means may be provided advantageously, e.g. to facilitate driving bolts on pipes.

Commercially available battery-powered wrenches are employed especially for driving operations in motor vehicle interiors. They are designed, for example, to transmit rotary torques of up to a maximum of 15 Nm. To facilitate easy manipulatability here, the housing is designed to consist of lightweight material, usually plastic. The housing of the proposed manual wrench can be advantageously designed to be considerably more bend-

resistant than known housings since the housing not only must fulfill a protective function for the motor drive unit of the manual wrench, but must also withstand the forces to be transmitted manually.

The grip of the manual wrench is advantageously designed not only for operating the drive motor, for example, provided with a power switch, but the grip area is also designed such that the entire manual wrench may be manipulated like a purely manually operated wrench.

Due to the especially bending-resistant housing, the transmission of high tightening torques is possible at which traditional motorized manual wrenches would be destroyed, for example, levels 2 times or even over 10 times the torque to be applied by the motor. Due to this design of a battery-powered manual wrench, tightening torques of 40 Nm, 50 Nm, 100 Nm, or even higher than 150 Nm are possible compared with the traditional 15 Nm.

The housing may consist of plastic, especially a fiber-reinforced plastic, to ensure the desired bending strength of the housing. However, the housing may preferably consist of metal, here preferably of a light metal to ensure fatigue-free manipulation.

The following describes an embodiment of the invention based on the drawing.

Fig. 1 shows a cross section of the head area of a manual wrench.

Fig. 2 shows a sectional view along line II–II in Fig. 1.

In the drawing, 1 generally refers to a head of a manual wrench. Head 1 is designed as an angle head and attached to a rod-shaped housing of a so-called rod-type wrench; the housing is made of a lightweight metal alloy which provides the high bending strength of the housing. The rod-type wrench contains a complete drive unit with a power storage means or a connection for a power supply, a drive motor, a power switch for the drive motor, and an integral torque limiter which limits the torque that can be transmitted by the motor to the output shaft of the drive unit in known fashion, e.g. by switching off the motor in the case of an electric motor, by partially or completely bypassing the driving air in the case of a compressed-air motor, or in a similar manner.

Rod-type wrenches are themselves well known so that for the sake of clarity only the end of shaft 2 of the rod-type wrench is visible in the drawing.

Head 1 has a housing 3 in which a known angled arrangement for a power offset drive is provided. An output shaft 4 is provided at head 1, the free end of said shaft being square and serving to accommodate attaching sockets.

The output shaft 4 is extended to the rear and may be of one-piece or multi-piece design. It extends from and beyond the actual housing 3 of head 1 and extends up to a torque limiter 5 visible especially in Figure 2. Said torque limiter is designed as a so-called articulated wrench in a manner similar to a basically known torque limiter. Said torque limiter has a ratchet drive 6 with a change-over switch 7 for selecting the working direction of torque transmission, and said torque limiter has an articulated joint 8 whose articulated body 9 is gripped between a first support by an indicated spring 10 and a second support 15. Spring 10 may be released or tensioned by a setscrew 11 so that the pretensioning of articulated joint 8 is adjustable, and as is the torque at which the articulation of articulated joint 8 occurs.

Support 15 is mounted to pivot around a pivot axis that coincides with the axis of output shaft 8. Articulated body 9 can perform the articulating motion through the pivotal motion of said support 15. Because the pivot axis of support 15 coincides with output shaft 4 limited in its transmitted torque, a lever arm between a pivot axis of support 15 and this torque-limited shaft is obviated.

Such a lever arm would cause the shutoff torque of torque limiter 5 to be influenceable by the fact that the manual wrench is gripped a different places along its shaft, and by the fact that the user could apply leverage between the ball of the thumb and the thumb, thereby introducing a moment into the manual wrench, which moment acts as a lateral force on the lever which is thus required between the point of attachment of the support of the articulated joint and the torque-limited shaft. Said effects are excluded from the manual wrench shown so that, once set, the shutoff torque of torque limiter 5 is reliable and can be maintained with great uniformity so that overall very precise screwing operations may be obtained.

In the embodiment presented, the torque-limited shaft is simultaneously the output shaft 4 of the manual wrench. The positive effects described still remain in the

event an interposed gear means is used between the actual output shaft and the shaft for which the torque is to be limited, which shaft coincides with the pivot axis of support 15.

For example, if a flat output means were used, the bolt axis would not coincide, as in the embodiment shown, with the pivot axis of support 15. Nevertheless, the torque-limited axis, i.e. an output shaft serving as a drive shaft for the flat output means, would coincide with this pivot axis of support 15 so that the advantages described remain intact.

In the case of a slight variation of the embodiment shown, for example, a minimal offset between the pivot axis of support 15 and the torque-limited shaft such as the output shaft 4 shown, the aforementioned advantages are still present in only slightly reduced form since the leverage or lateral forces introduced by the user into the tool affect the shutoff torque of torque limiter 5 to increasingly smaller degrees, the smaller the distance is between the two axes mentioned.

In a variation of the embodiment shown, housing 3 may surround torque limiter 5 so that only setscrew 6 and an operating grip for the change-over switch 7 are visible to the user outside housing 3.

Head 1 is fastened by an adapter 12 to shaft 2: Adapter 12 has a housing 14 which has both a connection means for the output shaft of the rod-type wrench and a connection means for the drive shaft of head 1. By using different adapters, head 1 may be used on different types of manual wrenches; and conversely, a multiplicity of differently designed heads may be used on the shaft 2 shown by using appropriate adapters.

Claims:

1. Motor-driven manual wrench containing a drive motor to which a first torque limiter is attached

and containing a head (1) that has the driving tool or a receptacle for a driving tool,

a ratchet drive (6) and a torque limiter (5) attached to ratchet drive (6) being located in head (1) such that the manual wrench forms a manually operable torque wrench whose transmittable torque is determined by torque limiter (5).

2. Manual wrench according to Claim 1, characterized in that head (1) is mounted replaceably on the rest of the wrench.

3. Manual wrench according to Claim 1 or Claim 2, characterized by an adapter (12) which is connected to the drive shaft of head (1), and to the output shaft of the motor.

4. Manual wrench according to one of the foregoing claims, characterized in that head (1) is designed as an angle head whose output shaft is offset relative to the drive shaft.

5. Manual wrench according to one of the foregoing claims, characterized in that torque limiter (5) is designed to be adjustable such that the transmittable tightening torque is adjustable to specified values.

6. Manual wrench according to one of the foregoing claims, characterized in that the torque limiter (5) has an articulated joint (8),

with an articulated body (9) held between two supports,

the one support (15) being pivotably mounted at a distance from articulated body (9), said support enabling an articulating motion between this support (15) and articulated body (9),

and the pivot axis of this support (15) coinciding with the axis of shaft (4) whose transmittable torque is limited by torque limiter (5).

7. Manual wrench according to one of the foregoing claims, characterized by a visual display which is activatable when a specified tightening torque is obtained.

8. Manual wrench according to Claim 7, characterized in that the display is mechanically activatable.

9. Manual wrench according to one of the foregoing claims characterized by an electrical sensor which generates a signal when the specified tightening torque is obtained.

10. Manual wrench according to Claim 9, characterized by an electronic circuit which is effectively connected with the sensor, the circuit activating an acoustic and/or visual display when the predetermined number of driving operations implemented with a specified tightening torque is obtained.

11. Manual wrench according to Claim 9 or Claim 10, characterized by an electronic circuit which is effectively connected with a sensor, the circuit activating an acoustic and/or visual display when a signal is received from the sensor.

12. Manual wrench according to Claims 8 through 11, characterized in that the display is located at head (1).

13. Manual wrench according to one of the foregoing claims, characterized in that the manual wrench has an elongate design as a rod-type wrench.

14. Manual wrench according to one of the foregoing claims, characterized in that a flat output means is located at head (1).

15. Manual wrench according to one of the foregoing claims, characterized in that the manual wrench is equipped with a wireless power supply for the motor.

16. Manual wrench according to one of the foregoing claims characterized by a tubular housing accommodating the motor and drive train, which housing is designed with high bending strength, which bending strength during manipulation of the wrench allows for the transmission of considerably higher tightening torques to the driving operation than from the motor drive, with the rod-shaped housing having a grip area for manual actuation of the manual wrench.

17. Manual wrench according to Claim 16, characterized in that the housing consists of metal.

18. Manual wrench according to Claim 17, characterized in that the housing consists of light metal.

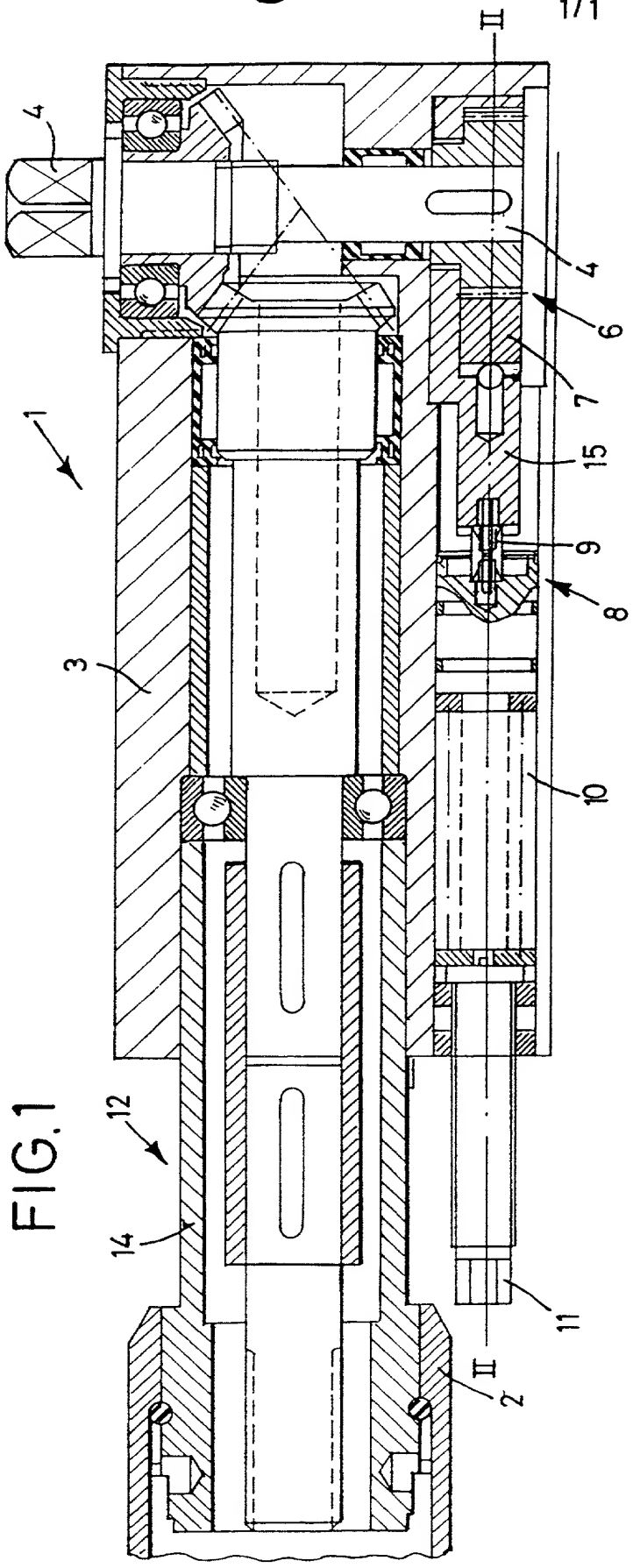

FIG.1

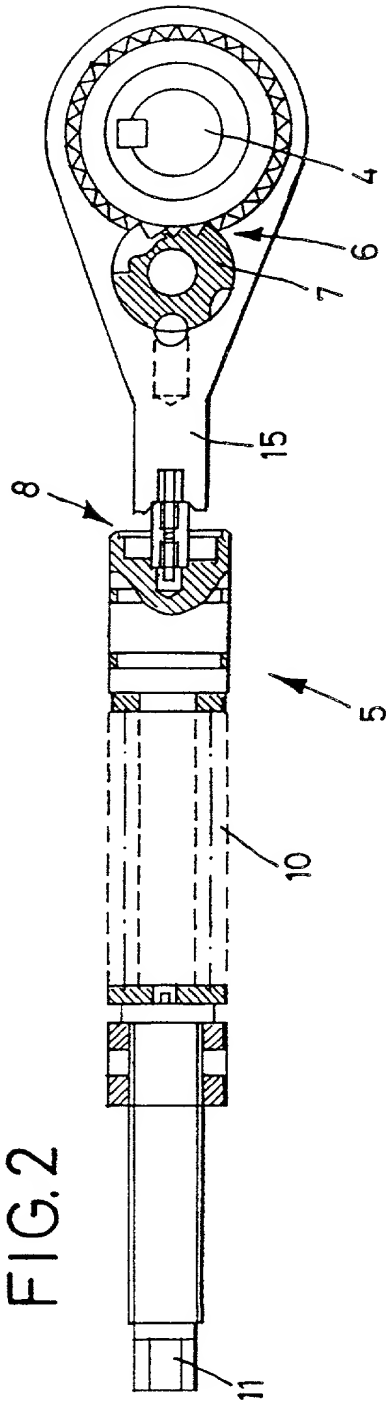

FIG.2

DECLARATION, PETITION AND POWER OF ATTORNEY FOR PATENT APPLICATION

(Check one):

- ☒ Declaration Submitted with Initial Filing
- ☐ Declaration Submitted after Initial Filing

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

MOTOR-DRIVEN SCREW DRIVER

the specification of which (check one):

☐ is attached hereto.

OR

☒ was filed on **14 September 1999** as PCT International Application Number **PCT/DE99/02906**, and was filed as U.S. Serial No. **09/554,343**

☐ and was amended by PCT Article 19 Amendment on _____ (if applicable),

☐ and was amended by PCT Article 34 Amendment on _____ (if applicable).

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

PRIORITY CLAIM

(Check one):

☐ no such applications have been filed.

☒ such applications have been filed as follows

1) FOREIGN PRIORITY CLAIM: I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (dd,mm,yyyy)	Priority Not Claimed	Certified Copy Attached Yes	Certified Copy Attached No
198 41 870.1	**DE**	**14 September 1998 (14.09.98)**	☐	☐	☒
299 08 022.6	**DE**	**05 May 1999 (05.05.99)**	☐	☐	☒
299 08 023.4	**DE**	**05 May 1999 (05.05.99)**	☐	☐	☒
299 10 742.6	**DE**	**19 June 1999 (19.06.99)**	☐	☐	☒

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto.

2) PROVISIONAL PRIORITY CLAIM: I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.

Provisional Application Number(s)	Filing Date (dd,mm,yyyy)

☐ Additional provisional application numbers are listed on a supplemental priority sheet attached hereto.

3) U.S./PCT PRIORITY CLAIM: I hereby claim the benefit under Title 35, United States Code, §120 of any United States application or §365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (dd,mm,yyyy)	Parent Patent Number *(if applicable)*
	PCT/DE99/02906	**14 September 1999 (14.09.99)**	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.

POWER OF ATTORNEY:

As a named inventor, I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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Wherefore I petition that letters patent be granted to me for the invention or discovery described and claimed in the attached specification and claims, and hereby subscribe my name to said specification and claims and to the foregoing declaration, power of attorney, and this petition.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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